Space Weather Technical Forecast

Issued on Friday, 12 July 2024 at 13:12 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: R1s Likely. Peak Chance of G1 over UTC weekend days.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity fell to Low, as recorded at GOES16, with frequent small C-class flares mainly emanating from the largest central sunspot group, AR3738. This was one of up to nine regions on the disc, with AR3748 recently designated in the northeast near a second small unnumbered region here as AR3740 faded in the southwest. Nominally the most complex region, AR3738 continued to show some weak delta spot candidates in its nevertheless expansive and potent 17-degree Fki Zurich classification. There has been slight proliferation of spots and penumbral growth in the trailing portion of this group. The other region of note was AR3743 in the east, which saw some emergence of intermediate spots to the north of the group as a Dsi/Beta.

No Earth-directed Coronal Mass Ejections (CMEs) were noted in the period, with the main events in coronagraph imagery being CMEs from narrowly behind the western limb around the turn of the UTC day 11 into 12 July, and also a prominence eruption from the southeast around 12/0500UTC. Neither is expected to alter the forecast.

Solar Wind / Geomagnetic Activity: Slow solar wind conditions were observed at L1 by ACE. The solar wind speed fell very slightly from the high 300s of km/s to finish nearer 350km/s. The solar wind density was unremarkable within typical single figures ppcc, with the IMF similarly subdued with a peak at 5nT and a north-south range of +/-5nT. The phi angle was negative (towards the Sun).

The net result of the above solar wind measures was provisionally Quiet geomagnetic indices, with a peak Kp of '2+' recorded at 00-03UTC.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 remained at Background levels.

High energy electron flux (greater than 2MeV) observed by GOES16 was predominantly at Normal Background levels. The 24-hour fluence was below Active, with 2.29e6 integrated pfu observed at 12/0001UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: M-class flares remain Likely, with AR3738 the most probable source. No significant regions are due to depart or arrive in the period.

Solar Wind /Geomagnetic Activity: No Earth-directed CMEs currently feature in the forecast. Initial slow wind conditions may give way to a chance of slight enhancement from any fast wind interaction from the small southwestern coronal hole CH53 within the remainder of the current

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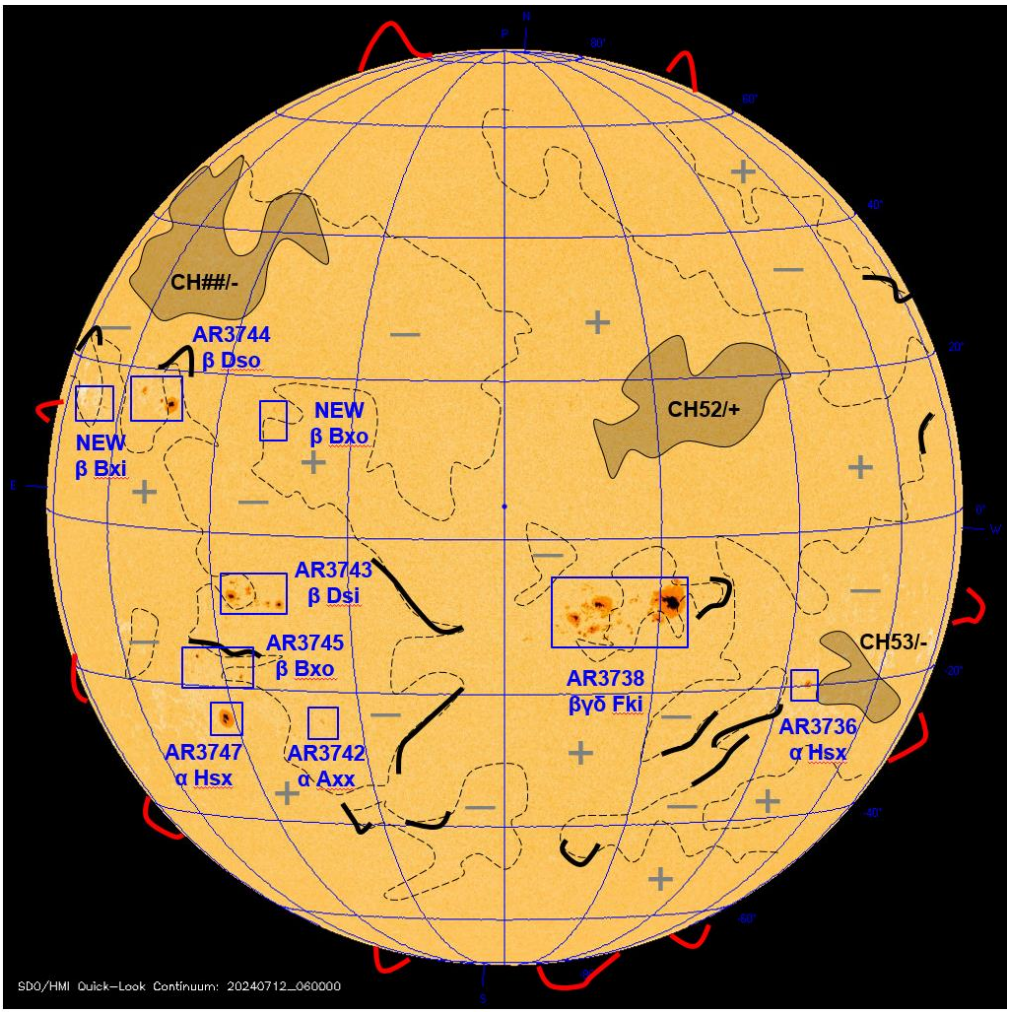
UTC day of 12 July. A more notable enhancement is then likely over the UTC weekend due to the onset of the fast winds of CH52. By the new working week the solar wind is expected to decline to Background levels.

Initially Quiet geomagnetic conditions may increase to become Unsettled in the current UTC day (12 July). Active to G1/Minor geomagnetic storm is then possible over the UTC weekend days before reverting to Quiet to Unsettled conditions into the new UTC working week.

Energetic Particles / Solar Radiation: High energy proton flux carries a daily Slight Chance of rising to exceed S1 in response to any notable flares from AR3738. This risk increases very slightly as this region progresses westwards in the period, with other regions contributing relatively little.

High energy electron flux is expected to remain mostly at Normal Background levels, but may respond to any fast wind enhancement, increasing to Moderate or perhaps High on days 3 and 4 (14 and 15 July). The associated 24-hour fluence is expected to remain below the Active level, but with a slightly increasing trend later in the period.

Figure 1. Solar Analysis Valid 12/0600UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No CMEs feature in the current forecast.

Current slow wind conditions may become slightly enhanced in the remainder of the current UTC day (Friday 12 July) due to the onset of the fast wind from CH53 located in the southwestern quadrant. The extent of any enhancement is low confidence, due to the small size and weak appearance of CH53, therefore any connection is expected to be weak. MOSWOC Enlil is over-estimating the extent of this feature, therefore is currently providing poor guidance. Slightly elevated solar winds are possible, perhaps increasing geomagnetic activity from initially Quiet to become Unsettled at times.

Any enhancement is likely to ease into the UTC weekend before the onset of the next fast wind, from north-centre disc CH52/+. This is a broad positive hole in the northwest quadrant, and fast wind onset is more assured, likely peaking later in the UTC day of Saturday 1 July or early day 3. This low confidence, as while the coronal hole did feature on the previous rotation, its appearance and location has changed, and Enlil is also unable to provide good guidance due to the over-estimation of the southwestern coronal hole. Elevated winds are likely by the end of day 2 into day 3 (13-14 July), potentially increasing activity to Active to G1/Minor Geomagnetic Storm levels - a peak for the forecast period. Through day 4 (Monday 15 July) solar wind speeds are expected to gradually decline, probably back to Background levels, as geomagnetic activity also declines.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	**G1 to G2**	No	1	50	50	10
Strong	**G3**	No	1	1	1	1
Severe	**G4**	No	1	1	1	1
Extreme	**G5**	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

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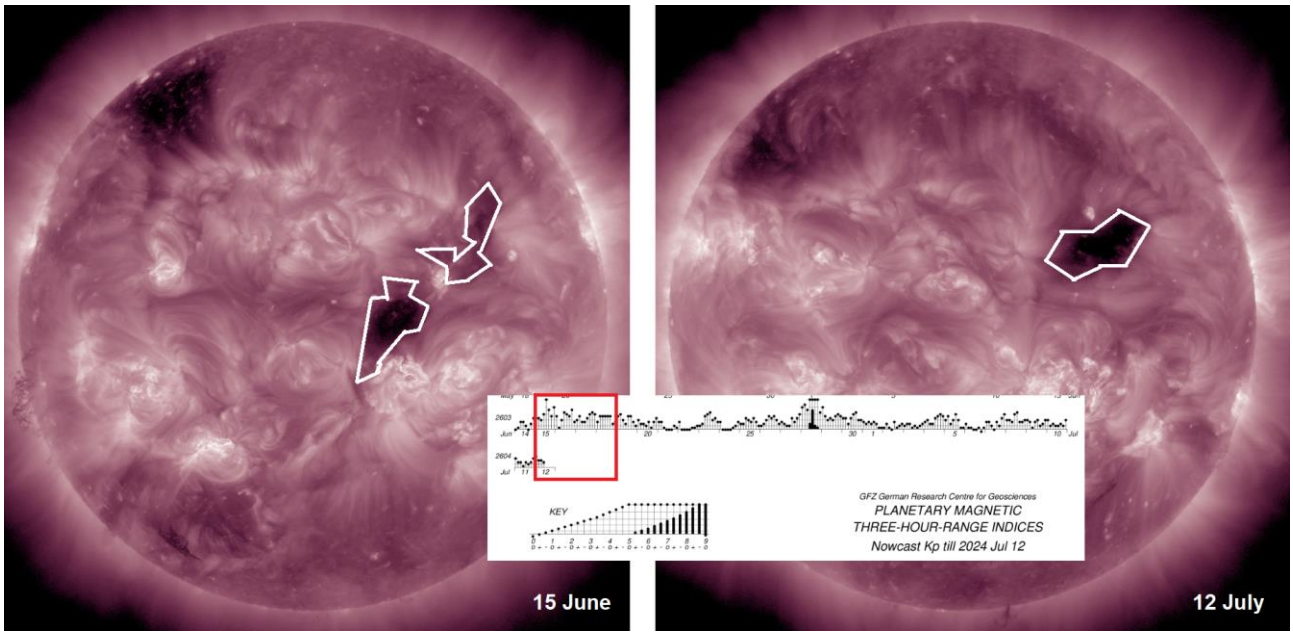
Figure 2: AIA211 imagery from the previous and current rotations, showing CH52 and its predecessor as well as resultant geomagnetic activity in the embedded Bartels music plot (retrieved 12/1130UTC from https://kp.gfz-potsdam.de/en/figures/bartels-music).



Radio Blackouts - X-Ray Flares:

Recent frequent C-class flares have largely originated from the main central sunspot region, AR3738, although there have been contributions from numerous other groups. The reasons for AR3738 having been through a recent quieter phase are not clear from its remaining complexity, and although the risks have been reduced slightly relative to past similar spots, there is felt to remain a Likelihood of M-class flares.

As for the tendency, no significant regions on the current front side depart the disc in the period, and the returning Carringtons expected in the period are not expected to reveal any large returning groups leading to an overall flat trend in risk.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	60	60	60	60
Very Active	R3 to R5 X Class	No	5	5	5	5

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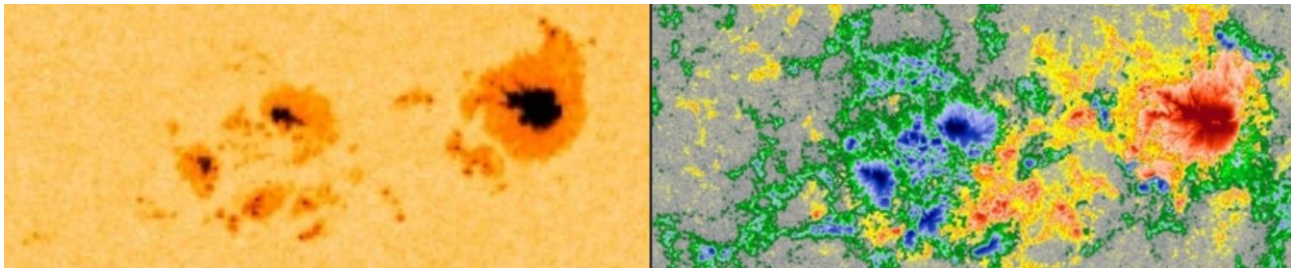
Figure 3: HMIIF and HMIBC imagery from 12/1130UTC, showing AR3738 in its Fki/BGD complexity, although there are now some signs of the main penumbra becoming more symmetric.



Solar Radiation Storms - (High Energy Protons):

High energy proton flux at GOES18 is at Background levels. It is most likely to remain at background levels, but with a slight chance of exceeding the S1/Minor radiation storm threshold should any larger flares occur, these perhaps most likely from AR3738. As this region rotates across the southwest quadrant, the probability of reaching S1 increases slightly.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	10	10
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

High Energy Electrons Event (≥ 2MeV):

High energy electron flux observed at GOES16 has been at Normal Background levels. Possible fast wind enhancements from coronal holes 53 and then 52 may occur into and over the coming weekend which may eventually increase electron populations at GEO, however the scale of these enhancements is not expected to be large, and the onset of any upward trend in fluence will probably not occur until the end of the period. MOSWOC REFM is good guidance in its continuation of current subdued fluence within the scope of its 72-hour range, however some form of uptick may start to appear as Monday 15 July becomes its new forecast horizon.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	5	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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